University of Tripoli – Faculty of Engineering
Electrical & Electronic Engineering Department
EE463 Final Exam Time: 2 hr Fall 2018 12/2/2019

Q1) a-Using RTD PT100 for temperature range (22C to 190C),design a signal conditioning circuit for (0–3V) ADC.(use voltage divider circuit , V_S=9V,R1=200Ω).

b-If we will send the sensor output for a distance with same voltage reference.

c-What is the ADC digital output if the temperature is 100C.

d-What is the temperature if the ADC output is (10011110). Vref = 2V [14 pts]

Q2) Using Acceleration sensor (sensitivity =0.14mA/g),with offset 7mA@0g, for the range (±30g) and using voltage to frequency converter VFC (scale factor= 4V/6KHz) .

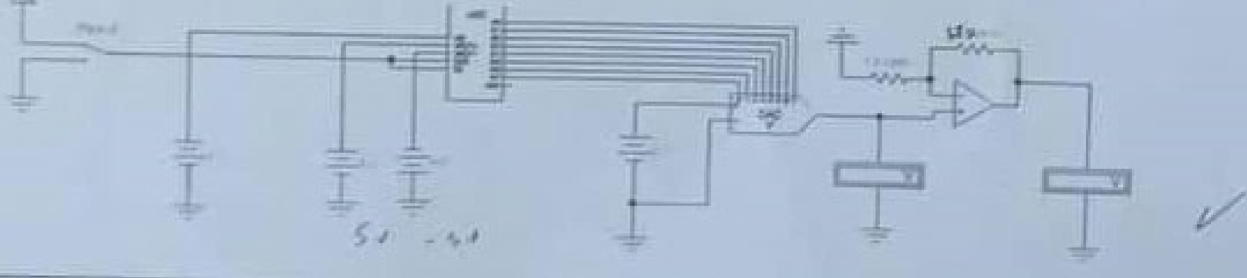
a-Draw the block diagram of the operation.

b-Calculate the sensor output range, and VFC output range, digital output of counter if the sampling is each 0.2Sec.

c-What is the value of the output of the counter if the acceleration is -0.5g. [10 pts]

Q3) Barometer sensor sensitivity is 5mV/ bar , and 5Ω/cm pot. level sensor for 150cm range used for measuring level (V_S=9Vuse, R1= 150 Ω) ,Design) circuit to turn ON green LED if (level more than 70cm and pressure less than 5bar),red LED if one of them opposite these values. [10 pts]

Q4) What is the value of voltmeters and ADC and DAC outputs. [8 pts]



5v -5v

Q5) a- Using Thermocouple sensor Type K with 0C reference, What is the value of temperature if its output is 19mV, What is its output at the temperature V_{K10}(-40C)=?. [8pts]

Good Luck (Zeyad)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 90min Spring 2016 5/4/2016

Q1.a) A liquid level sensor has an input range of 0 to 15cm. Use the calibration results given in the table to estimate the maximum hysteresis as a percentage of f.s.d?

Level h cm	0	1.5	3	4.5	6	7.5	9	10.5	12	13.5	15
Output volts h increasing	0	0.35	1.42	2.4	3.43	4.35	5.61	6.5	7.77	8.85	10.2
Output volts h decreasing	0.14	1.25	2.32	3.55	4.43	5.7	6.78	7.8	8.87	9.65	10.2

Q1.b) A temperature sensor has a span of 20-250C. A measurement results in a value of 55C for the temperature. Specify the error if the accuracy is:

1- ±0.5% fs 2- ±0.75% of span 3- ±0.8% of reading

What is the possible temperature in each case? [6 pts]

Q2.a) Drive the equation of the bridge offset voltage for the current balance bridge?

Q2.b) Design a high-pass RC filter that must drive 120HZ noise down to 1% using a capacitor 0.01μf. Specify the attenuation of a 30KHZ signal?

Q2.c) Signal conditioning analysis shows that the following equation must relate output voltage to input voltage: $V_o=3.35V_{in}-2.68$

Design circuits to do this using (a) a summing amplifier (b) a differential amplifier?

[8 pts]

Q3.a) A 12-bit bipolar DAC has a 10v reference

1- What output voltage results from digital input of 4A6 H.

2- An output of 4.74v is needed. What digital input would come closest to this value? By what percentage is the actual output different?

Q3.b) Using timing diagram, explain the control lines that coordinate the operation of ADCs? [6 pts]

Good Luck

$3.35V_{in}-$ $\frac{R_f}{R_a}(V_{Ra}-V_{in})$

$V_o=\frac{R_f}{R_a}\times V_{Ra}-\frac{R_f}{R_a}V_{in}$ $\frac{R_f}{R_a}=1$

7

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam Time: 2 hr Spring 2017 3/2/2018

Q1) Temperature sensor sensitivity is 4Ω/°C , in the range (±25°C) and its value at 0°C is 280Ω, Using Wheatstone bridge convert its range to volt , and send its value using (4mA -20mA transmitter) ,and prepare it for 8bit ADC with voltage reference 0-5Vref..

a) What is the digital output of ADC at the temperature -2 °C. [12 pts] (99)d [illegible]

Q2) Accelerometer sensor sensitivity is 0.33mA/[illegible] used for measuring Acceleration in the range (± 20 g). Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) What is the digital output of ADC at the acceleration is -3 g. 103 or 104

b) What is the acceleration when the digital output is 06H. -19 -6 [12 pts]

(Q3) Design the signal conditioning circuits to connect the sensor to 10 bit ADC with voltage reference (0-5V), where: sensor output range (-150 – +150 mV) with frequency 15Hz. Noise signal 20mV with frequency 150Hz, and design filter that Attenuate the noise signal to 25%, and taking in account the effect of the filter on the sensor signal. [10 pts]

Q4) Using Thermocouple sensor Type J with 0°C reference ,find the value of its output at 32°C. Design circuit to operate cooler if the temperature is more than 32°C, and using RTD with the following table using linear approximation of resistance versus temperature find the value of the RTD at 13°C and design circuit operate heater if the temperature is less than 13°C. [12 pts]

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	107.6	109.1	110.2	111.1	111.7

X

(Q5) What is the sampling and sample and hold and aliasing and oversampling (Draw as you can) . [4 pts]

Good Luck (Zeyad)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 75min Spring 2017 18/4/2017

Q1.a) An alarm light goes ON when a pressure sensor voltage rises above 4.00 V. The pressure sensor outputs 20 mV/kPa and has a time constant of 4.9 s. How long after the pressure rises suddenly from 100 kPa to 400 kPa does the light go ON?

Q1.b) A load cell is calibrated at $21^{c^{\circ}}$ and has the following deflection/load characteristic:

Load(kg)	0	50	100	150	200
Deflection (mm)	0	1	2	3	4

When used at $35^{c^{\circ}}$, its characteristic changes to the following:

Load(kg)	0	50	100	150	200
Deflection (mm)	0.2	1.3	2.4	3.5	4.6

Determine the sensitivity coefficients [10 pts]

Q2.a) A measurement signal has a frequency less than 1KHz, but there is unwanted noise at about 1MHz. Design a filter that attenuate the noise to 1% using a capacitor 0.01µf. What is the effect on the measurement signal at its maximum of 1KHz (give a comment on the result)?

Q2.b) Signal conditioning analysis shows that the following equation must relate output voltage to input voltage: $V_o=3.35V_{in} - 2.68$. Design circuits to do this using a differential amplifier? [12 pts]

Q3.a) Using timing diagram, explain the control lines that coordinate the operation of ADCs?

Q3.b) Design a 5-bit weighted-resistor DAC whose full-scale output voltage is -15v. Logic levels are 1=5v and 0=0v. What is the output voltage when the input is 01010?

[10 pts]

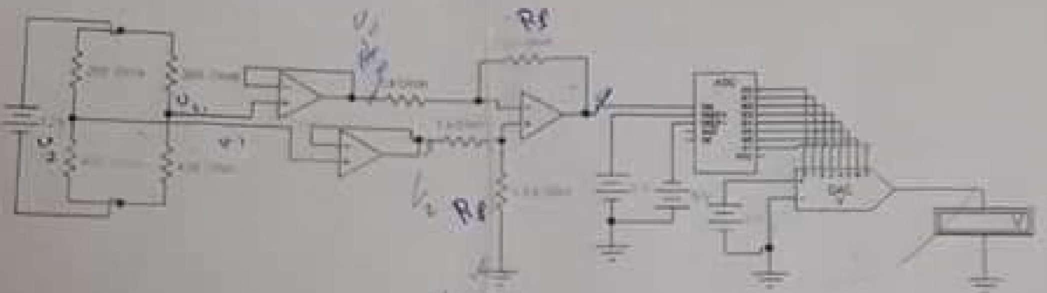
Good Luck

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 2nd Exam Time: 1: 30 hr spring 2018 1/1/2019

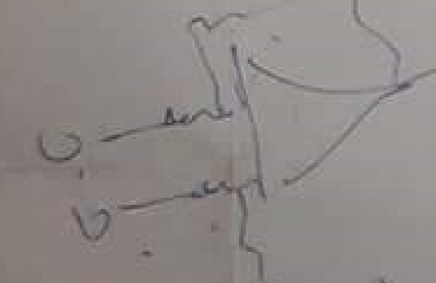
Q1)From the circuit below what is the value of ADC digital outputs and DAC analog output.



Q2) A measurement signal has a frequency 800Hz,but there is unwanted noise at about 10KHz ,Design filter that attenuate noise as possible with better effect on the signal(give the 3 attempts with comments).

Q3) using accelerometer which sensitivity 0.3mA/g , and using R=200Ω for voltage conversion, and using VFC which scale factor 5KHz/V, sampling time 0.1sec :

A) Draw the block diagram of the operation
B) What is the digital output(in binary) if the acceleration is 11g.
C) What is the value of acceleration if the digital output is $(190)_{10}$



Good Luck (Zeyad Hamza)

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University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam Time: 2 hr Fall 2018 12/2/2019

Q1) a-Using RTD PT100 for temperature range (22C to 190C),design a signal conditioning circuit for (0–3V) ADC (use voltage divider circuit ,Vs=9V,R1=200Ω).

b-If we will send the sensor output for a distance with same voltage reference.

c-What is the ADC digital output if the temperature is 100C.

d-What is the temperature if the ADC output is (10011110). [14 pts]

Q2) Using Acceleration sensor (sensitivity =0.14mA/g),with offset 7mA@0g, for the range (±30g) and using voltage to frequency converter VFC (scale factor= 4V/6KHz) .

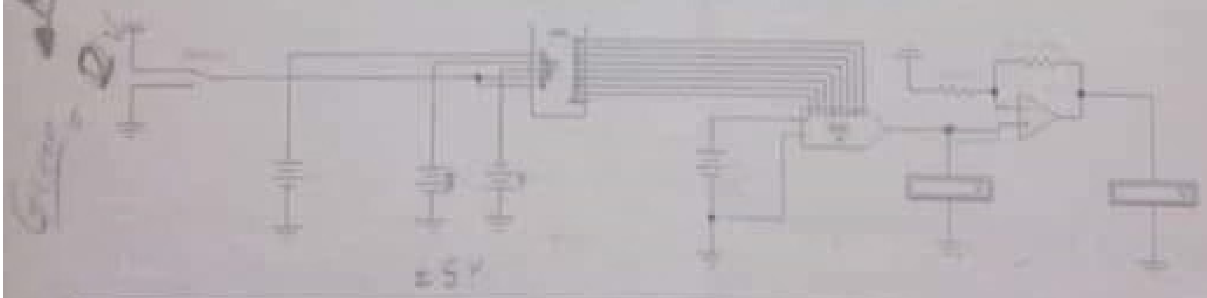
a-Draw the block diagram of the operation.

b-Calculate the sensor output range, and VFC output range, digital output of counter if the sampling is each 0.2Sec.

c-What is the value of the output of the counter if the acceleration is -0.5g. [10 pts]

Q3) Barometer sensor sensitivity is 5mV/ bar , and 5Ω/cm pot. level sensor for 150cm range used for measuring level (Vs=9Vuse, R1= 150 Ω) .Design) circuit to turn ON green LED if (level more than 70cm and pressure less than 5bar),red LED if one of them opposite these values. [10 pts]

Q4) What is the value of voltmeters and ADC and DAC outputs. [8 pts]



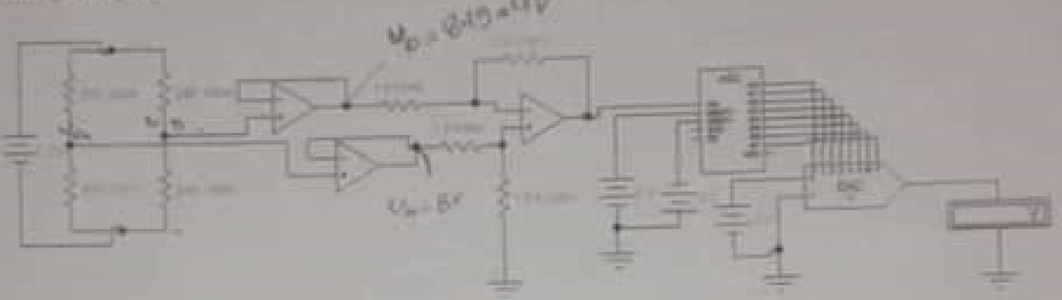
Q5) a- Using Thermocouple sensor Type K with 0C reference, What is the value of temperature if its output is 19mV, What is its output at the temperature V_{K10}(-40C)=?. [8pts]

Good Luck (Zeyad)

University of Tripoli – Faculty of Engineering
Electrical & Electronic Engineering Department

EE463 2nd Exam Time: 1: 30 hr spring 2018 1/1/2019

Q1)From the circuit below what is the value of ADC digital outputs and DAC analog output.



Q2) A measurement signal has a frequency 800Hz,but there is unwanted noise at about 10KHz ,Design filter that attenuate noise as possible with better effect on the signal(give the 3 attempts with comments).

Q3) using accelerometer which sensitivity 0.3mA/g , and using R=200Ω for voltage conversion, and using VFC which scale factor 5KHz/V, sampling time 0.1sec :

A) Draw the block diagram of the operation
B) What is the digital output(in binary) if the acceleration is 11g.
C) What is the value of acceleration if the digital output is $(190)_{10}$

Good Luck (Zeyad Hamza)

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 1: 30 hr spring 2018 20/12/2018

Q1)What elements of data acquisition system. explain two of them

Q2) Temperature sensor which sensitivity= 0.11mA/C̊, and its value @ 0C̊=5mA ,for temperature range (±40 C̊), and using R=150 Ω for converting to volt, voltage supply 12V.

A- Design circuit to send the sensor output for long distance and for ADC (Vref 0–4V).

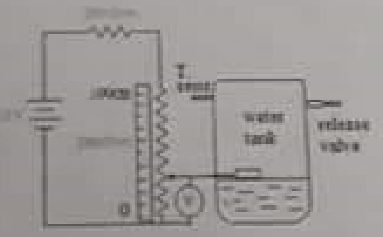
B- What is the digital output of ADC if the temperature is 33C, -14C ?

C- What is the temperature if the digital output is 88H?

Q3) Sensor used to measure pressure in range (0–30bar) with sensitivity (7mV/bar) , RTD PT100 to measure temperature, potentiometer used to measure the level as shown in figure.

A-Design circuit to turn ON buzzer if (temp is more than 49C or pressure is more 10 bar or level is less than 33cm)

B-Turn ON release valve if pressure is more than 15 bar.



Good Luck (Zeyad Hamza)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam- Time: 2 hr Spring 2019 25/9/2019

Q1) a-What is the meaning of single ended signal, differential signaland give example.

b- What is sample and what is hold and when we use them. [6 pts]

Q2) Using Temperature sensor (RTD-PT100),in the range (30C to 90C) and using Wheatstone bridge (Vs=9V, R1=110, R2=120),and using voltage to frequency converter VFC (scale factor= 10KHz/1.12V) .

a- Calculate the sensor output range, Wheatstone bridge output range and VFC output range.

b- Using a counter to convert to digital with sampling rate 180 sample/Sec.What is the output range of the counter, what is the value of the output of the counter if the temperature is ~~50~~C . 55C°

c- Draw Block diagram of the circuit. [16 pts]

Q3) An accelerometer sensor sensitivity is 0.145mA/ g , used for measuring pressure in the range (± 20 g). and the value of its output @ 0 g is 5.2mA, using 190 Ω converting to volt resistance ,Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) Calculate sensor output range (current,voltage,Binary).

b) What is the digital output of ADC at the acceleration is 8 g.

c) What is the value of accelration when the digital output is 0DH,92H. [15 pts]

d) If the frequency of the signal is 120Hz and there is unwanted noise with frequency 15KHz, design filter that attenuate the noise to 18% of its value, calculate the effect on the sensor output range. [05 pts]

Q4) Using RTD with the following table using Quadratic approximation of resistance versus temperature find the value of the RTD at 12.4°C.

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	103.6	105.1	106.3	107.1	108.3

[08 pts]

Good Luck (Zeyad)

c) $(10011110) = 158$ $\qquad V_o = D_o \Delta = 1.8515625V$

$V_{in} = \frac{V_o + offset}{M} = 3.797362007V$

$RTD = \frac{V_o R}{V_s - V_o} = 145.978329 \, \Omega$

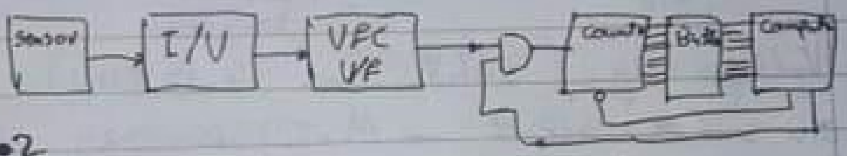
$T = \frac{RTD - 100}{0.39} = 117.8931516 \, C°$ ✱

b) we Use (4 – 20) mA transmitter where its Voltage range in (1 – 5)V and the output from the Voltage Divide Circuite is Suitable and in range of Use.

Q2: Acceleration $S = 0.14 mA/g$ @ $0g = 7mA$ $\pm 30g$

Use VFC $(4V/6kHz) = 1.5 kHz/V$

a)


Sensor
I/V
VFC
VF
Counter
Buffer
Computer

$T = 0.2$

b) range $(-30g \qquad +30g)$

$(7m + 0.14 \times 30 = 2.8mA \qquad 7 + 0.14 \times 30 = 11.2mA)$

assume $R = 100 \Omega$.

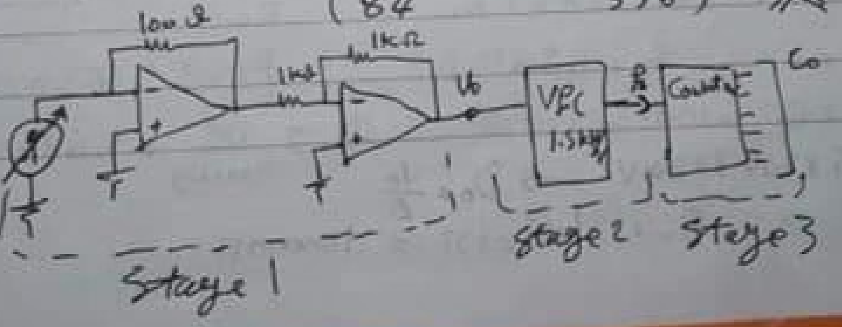
$V_o = IR \Rightarrow (0.28 \sim 1.12)V$

output from VFC = $(0.28 \times 1.5 \qquad 1.12 \times 1.5)$

$= (420 Hz \qquad 1680 Hz)$

Counter output range = $((420 \times 0.2) \qquad (1680 \times 0.2))$

$(84 \qquad 336)$ ✱


100 Ω
1kΩ
1kΩ
Vo
VFC
1.5kHz
Counter
Co
Stage 1
Stage 2
Stage 3

hite/Blanc
rrow Ruled/Réglé étroit
Sheets/50 feuilles

Spring 2018

Q1: - Single ended Signal: a Constant output Signal depence on the Parameters of the Circuit
- differential Signal: a Difference Signal at the output between two terminals ex. Bridge.

we Use Sample and hold because ADC needs a finite amount of time to measure the Signal Voltage.

Q2: 5mV/C, (30~120)C° VFC 0.5 kHz/V f_s = 10Hz
T = 0.1 s

Voltage range (30×5mV/C = 150mV   120×5mV/C = 600m
frequency range (150×0.5 = 75Hz   600×0.5 = 300Hz)
Counter range (75×0.1 = 7.5 = 7   300×0.1 = 30)

for Temperature 112C°   Vo = 112×5mV/C = 560mV
VFC = 0.5×560 = 280Hz, Co = 280×0.1 = 28 ※

Q3: 0.13mA/bar range ±20bar @0bar = 4mA R = 150
Using bipolar ADC 8bit ±4V
Ampere range ((−20×0.13)+4m = 1.4mA ~ (20×0.13m)+4 = 6.6mA)
Voltage range (1.4×150 = 210mV ~ 6.6×150 = 990mV)

−4 = 0.210 M + offset $M = \frac{400}{39}$ Vo = M Vin + offset
+4 = 0.99 M + offset $offset = -\frac{80}{13}$ $\Delta = \frac{8}{2^8} = \frac{1}{32}$

a) in 8bar find Do ⇒ ((8×0.13)+4)×150 = 756mV

$V_o = \frac{400}{39} \times 0.756 - \frac{80}{13} = 1.6$

Do = $\frac{1.6+4}{\Delta}$ = ~~[illegible]~~
5.6×32 = 179.2 ≈ 179 = $(10110011)_2$ ※

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 1: 30 hr spring 2018 20/12/2018

Q1)What elements of data acquisition system. explain two of them

Q2) Temperature sensor which sensitivity= 0.11mA/C̊, and its value @ 0C̊=5mA ,for temperature range (±40 C̊), and using R=150 Ω for converting to volt, voltage supply 12V.

A- Design circuit to send the sensor output for long distance and for ADC (Vref 0-4V).

B- What is the digital output of ADC if the temperature is 33C, -14C ?

C- What is the temperature if the digital output is 88H?

Q3) Sensor used to measure pressure in range (0~30bar) with sensitivity (7mV/bar) , RTD PT100 to measure temperature, potentiometer used to measure the level as shown in figure.

A-Design circuit to turn ON buzzer if (temp is more than 49C or pressure is more 10 bar or level is less than 33cm)

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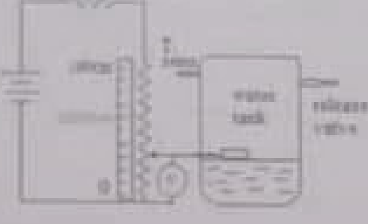

Good Luck (Zeyad Hamza)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 1: 30 hr spring 2018 20/12/2018

Q1)What elements of data acquisition system. explain two of them

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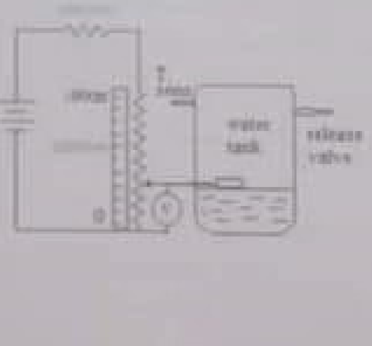


Good Luck (Zeyad Hamza)

[illegible]

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 2st Exam Time: 1:30 hr Fall 2016 20/12/2016

Q1.a) An ADC that will encode pressure data is required. The input signal is 666.6 mV/psi.
a. If a resolution of 0.5 psi is required, find the number of bits necessary for the ADC. The reference is 10.0 V?

b.Find the maximum measurable pressure?

Q1.b) An 8-bit DAC with a 5.00-V reference connects to a light source with an intensity given by $I_L = 45V^{[illegible]}\ W/m^2$. What intensities are produced by digital inputs of 1BH, 7AH?

[8 pts]

Q2.a) Describe the working principle of thermocouple sensors. What are techniques employed for reference junction compensation?

Q2.b) An RTD has α_0=0.005/C, R=500Ω, and a dissipation constant of P_D=30mW/C at 20C. The RTD is used in a bridge circuit with $R_1 = R_2$ = 500Ω and R_3 a variable resistor used to null the bridge. If the supply is 10 V and the RTD is placed in a bath at 0C, find the value of R_3 to null the bridge.

3-1

Q2.c) A resistive element of a wire-wound pot is made from 10in of 100Ω/in resistance and is wound as a coil of 200 loops. the range of the pot is 350 degree. What is the resolution of this pot?

[12 pts]

Q3.a) Describe the working principle of linear variable differential transformer?

Q3.b) A strain gauge has GF = 2.06 and R = 120 Ω, and is made from wire with α_0=0.0034/C at 25C. The dissipation factor is given as P_D=25mW/C. What is the maximum current that can be placed through the SG to keep self-heating errors below 1 micro of strain?

Q3.c) Water is pumped through a 1.5in diameter pipe with a flow velocity of 2.5ft/s. Find the volume flow rate and weight flow rate. The weight density is 62.4 lb/ft?

[12 pts]

$\boxed{Q = AV}$

Good Luck

Q) if $g = -0.5g$ find G

$G = \left(\left[\left(\left(g \times 0.14 \right) \div 7m \right) \times 0.1 k\Omega \right] \times 1.5 kH/N \right) \div T$

$G = 207.9 = 207$ ✱

Q3 : $S = 5mV/bar$, $5\Omega/cm$ pot for 150 cm

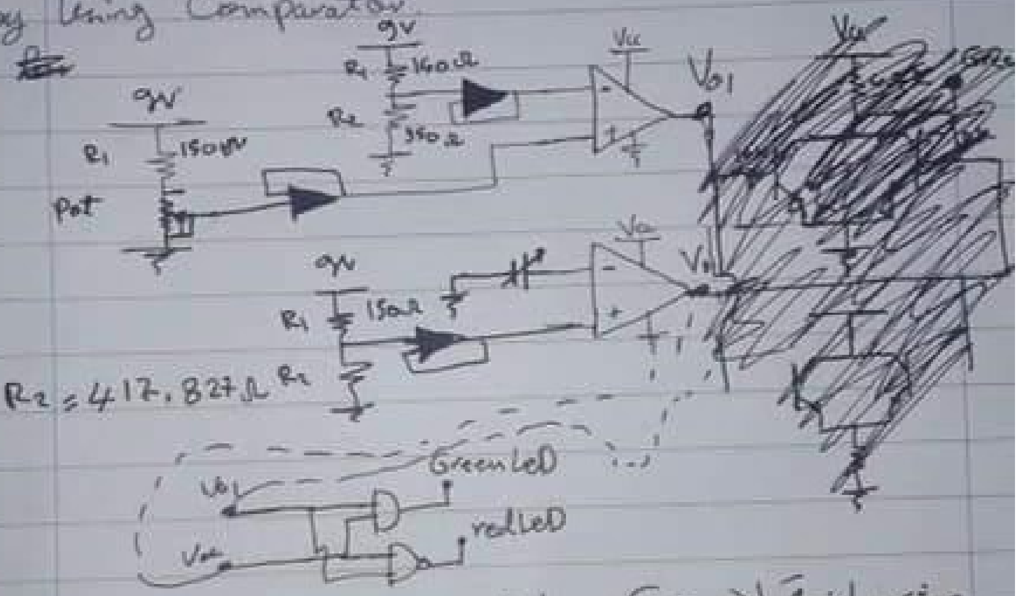
Use $V_s = 9V$, $R_1 = 150\Omega$, on Green if more than 70cm and less 5 bar) red on if else

① 5 bar ⇒ $5 \times 5mV/bar = 25mV$

② 70 cm ⇒ $70 \times 5\Omega/cm = 350\Omega$

③ 150 cm ⇒ $150 \times 5\Omega/cm = 750\Omega$

by Using Comparator


9V
R1
140Ω
R2
350Ω
Vcc
Vo1
Vcc
9V
R1
150Ω
Pot
Vcc
Vo2
9V
R1
150Ω
R2
Vo1
Vo2
Green LeD
red LeD

$R_2 = 417.827\Omega$

Q4) مش واضحة الصورة لكن ساهلة

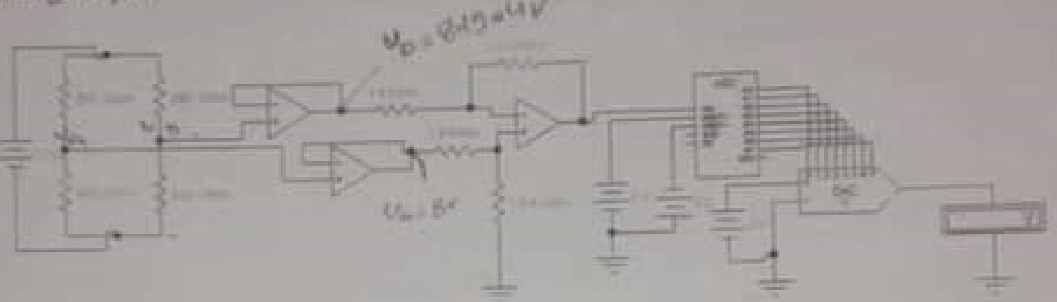
Q5) تقريباً غير داخل كان مطالب جداول وشرحات

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 2nd Exam Time: 1: 30 hr spring 2018 1/1/2019

Q1)From the circuit below what is the value of ADC digital outputs and DAC analog output.



Q2) A measurement signal has a frequency 800Hz,but there is unwanted noise at about 10KHz ,Design filter that attenuate noise as possible with better effect on the signal(give the 3 attempts with comments).

Q3) using accelerometer which sensitivity 0.3mA/g , and using R=200Ω for voltage conversion, and using VFC which scale factor 5KHz/V, sampling time 0.1sec :

A) Draw the block diagram of the operation
B) What is the digital output(in binary) if the acceleration is 11g.
C) What is the value of acceleration if the digital output is $(190)_{10}$

Good Luck (Zeyad Hamza)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam Time: 2 hr Fall 2018 12/2/2019

Q1) a-Using RTD PT100 for temperature range (22C to 190C),design a signal conditioning circuit for (0-3V) ADC.(use voltage divider circuit ,Vs=9V,R1=200Ω).

b-If we will send the sensor output for a distance with same voltage reference.

c-What is the ADC digital output if the temperature is 100C.

d-What is the temperature if the ADC output is (10011110). vref = 2V [14 pts]

Q2) Using Acceleration sensor (sensitivity =0.14mA/g),with offset 7mA@0g, for the range (±30g) and using voltage to frequency converter VFC (scale factor= 4V/6KHz) .

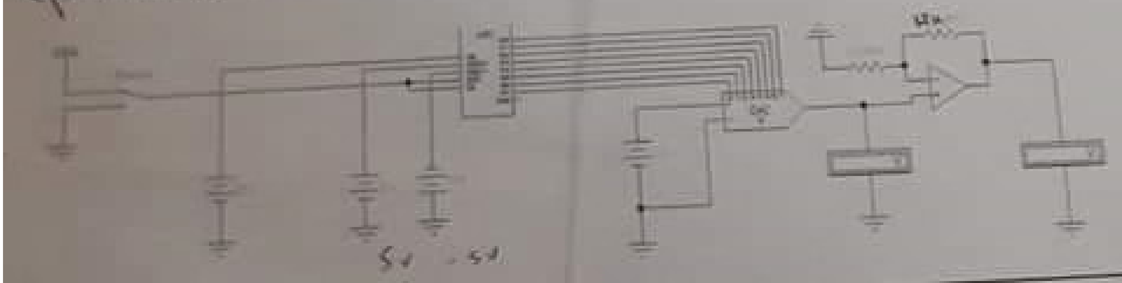
a-Draw the block diagram of the operation.

b-Calculate the sensor output range, and VFC output range, digital output of counter if the sampling is each 0.2Sec.

c-What is the value of the output of the counter if the acceleration is -0.5g. [10 pts]

Q3) Barometer sensor sensitivity is 5mV/ bar , and 5Ω/cm pot. level sensor for 150cm range used for measuring level (Vs=9Vuse, R1= 150 Ω) ,Design) circuit to turn ON green LED if(level more than 70cm and pressure less than 5bar),red LED if one of them opposite these values. [10 pts]

Q4) What is the value of voltmeters and ADC and DAC outputs. [8 pts]



Q5) a- Using Thermocouple sensor Type K with 0C reference, What is the value of temperature if its output is 19mV, What is its output at the temperature $V_{K10}(-40C)$=?. [8pts]

Good Luck (Zeyad

S2017

Q3 b) $0.25 = \frac{1}{\sqrt{1+\left(\frac{150}{f_c}\right)^2}} \Rightarrow f_c = \sqrt{\frac{150^2}{\frac{1}{0.25^2}-1}}$ = ~~[illegible] Hz~~

$= 10\sqrt{15} = 38.798$ Hz

the effect of filter on the signal

$\frac{1}{\sqrt{1+\left(\frac{15}{[illegible]}\right)^2}}$ = ~~[illegible]~~ 93.25 % ← Very ~~[illegible]~~ good Signal

[illegible] ~~[illegible] the filter should be~~ at ~~[illegible]~~ ~~filter~~

assume (HPF) $\Rightarrow f_c = \sqrt{\frac{f_s^2 - \%^2 f_s^2}{\%^2}} = \sqrt{\frac{150^2 - 0.25^2\,150^2}{0.25^2}} = 580.947$ Hz

the effect of filter on the signal

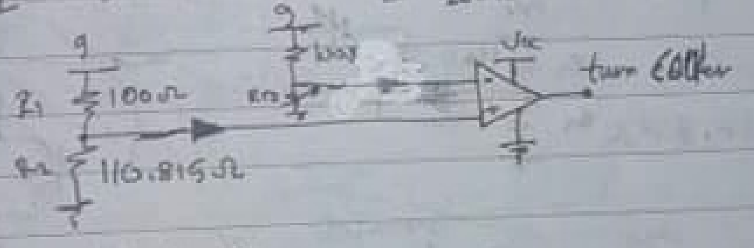
$\frac{f_s/f_c}{\sqrt{1+\left(\frac{f_s}{f_c}\right)^2}} = 2.58284$ % → × [illegible]

Q4: a, b → غير داخل

c) RTD with linear Approximation find R @ 13C°

$\alpha_0 = \frac{1}{R_0}\left(\frac{R_2-R_1}{T_2-T_1}\right) = \frac{1}{110.2}\left(\frac{111.7-107.6}{20-0}\right) = \frac{41}{22040}$ Ω/C

$R = R_0\left[1+\alpha_0 \Delta T\right) = 110.2\left[1+\frac{41}{22040}\times(13-10)\right] = 110.815$



Q5: from notebook ※

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 1: 30 hr spring 2018 20/12/2018

Q1)What elements of data acquisition system. explain two of them

Q2) Temperature sensor which sensitivity= 0.11mA/$\overset{o}{C}$, and its value @ 0$\overset{o}{C}$=5mA ,for temperature range (±40 $\overset{o}{C}$), and using R=150 Ω for converting to volt, voltage supply 12V.

A- Design circuit to send the sensor output for long distance and for ADC (Vref 0-4V).

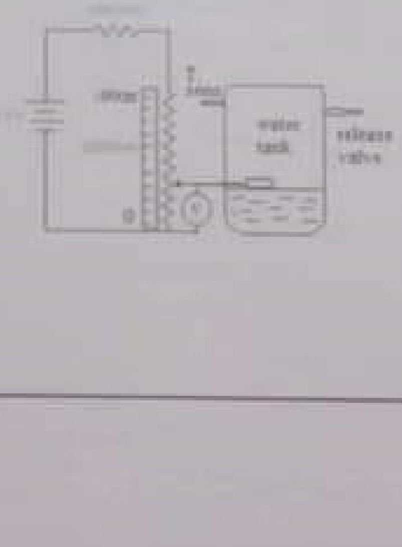
B- What is the digital output of ADC if the temperature is 33C, -14C ?

C- What is the temperature if the digital output is 88H?

Q3) Sensor used to measure pressure in range (0~30bar) with sensitivity (7mV/bar) , RTD PT100 to measure temperature, potentiometer used to measure the level as shown in figure.

A-Design circuit to turn ON buzzer if (temp is more than 49C or pressure is more 10 bar or level is less than 33cm)

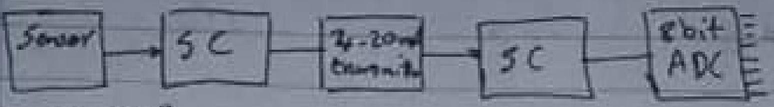
B-Turn ON release valve if pressure is more than 15 bar.



Good Luck (Zeyad Hamza)

Spring 2017

Q1 $4\Omega/C$ @$0C = 280\Omega$ Use Bridge and then 4-20mA trans and then 8bit ADC 0~5V


Sensor
SC
4-20mA transmitter
SC
8bit ADC

rang ±25C

$((-25\times4)+280 = 180\Omega \sim (25\times4)+280 = 380\Omega)$

Using Bridge withe $R_1 = R_2 = R_3 = 180\Omega$

$V_A = 9\times\frac{180}{180+180} = 4.5V$ $\quad V_b = 9\times\frac{180}{180+180} = 4.5V$

at nulling $V_{AB} = 0V$ ✻

at maximum $V_b = 9\times\frac{380}{180+380} = 6.107142857V$

$V_{AB} = 1.607142857V$ $\quad$ rang $(0 \sim 1.607142857)V$

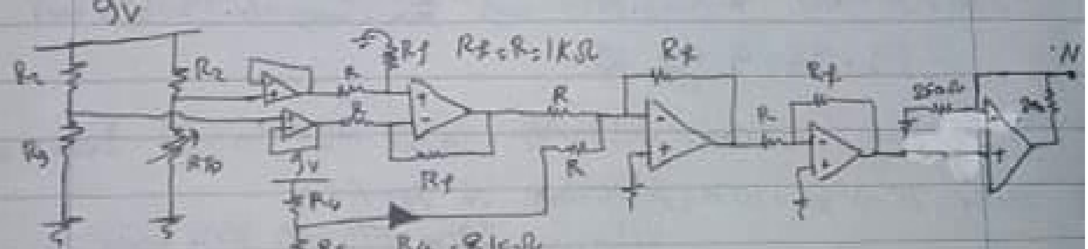
Using Summing Circuit to add the output of sensor with 1

output rang $(1 \sim 2.607142857)V$

we need SC for ADC

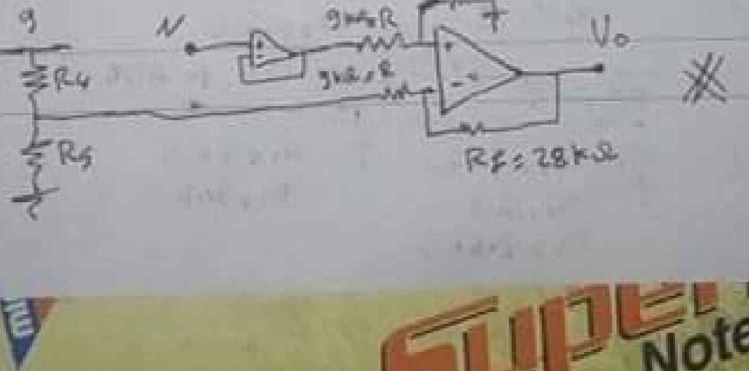
$0 = 1M + \text{offset}$ $\quad M = \frac{28}{9}$

$5 = 2.607142857M + \text{offset}$ $\quad \text{offset} = -\frac{28}{9}$ $\quad V_o = \frac{28}{9}(V_{in} - 1)$


9V
R1
R2
R3
R10
R
R
R1
Rf = R = 1KΩ
Rf
9V
R4
R5
R
R
Rf
Rf
R
250Ω
N

R4 = 8kΩ

R5 = 1kΩ $\quad$ Rf = 28 KΩ


9
R4
R5
N
9kΩ R
9kΩ R
Vo
Rf = 28kΩ

✻

University of Tripoli - Faculty of Engineering
Electrical & Electronic Engineering Department
EE463 Final Exam Time: 2 hr Spring 2017 3/2/2018

Q1) Temperature sensor sensitivity is 4Ω/°C , in the range (±25°C) and its value at 0°C is 280Ω, Using Wheatstone bridge convert its range to volt , and send its value using (4mA -20mA transmitter) ,and prepare it for 8bit ADC with voltage reference 0-5Vref..
a) What is the digital output of ADC at the temperature -2 °C. [12 pts] (99)d (99)h

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Q2) Accelerometer sensor sensitivity is 0.33mA/g used for measuring Acceleration in the range (± 20 g). Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) What is the digital output of ADC at the acceleration is -3 g. 103 or 106
b) What is the acceleration when the digital output is 06H. -19.6 [[illegible]ts]

Q3) Design the signal conditioning circuits to connect the sensor to 10 bit ADC with voltage reference (0-5V), where: sensor output range (-150 – +150 mV) with frequency 15Hz. Noise signal 20mV with frequency 150Hz, and design filter that Attenuate the noise signal to 25%, and taking in account the effect of the filter on the sensor signal. [10 pts]

Q4) Using Thermocouple sensor Type J with 0°C reference ,find the value of its output at 32°C. Design circuit to operate cooler if the temperature is more than 32°C, and using RTD with the following table using linear approximation of resistance versus temperature find the value of the RTD at 13°C and design circuit operate heater if the temperature is less than 13°C. [12 pts]

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	107.6	109.1	110.2	111.1	111.7

X

Q5) What is the sampling and sample and hold and aliasing and oversampling (Draw as you can) [4 pts]

Good Luck (Zeyad)

3

1.5 1.5

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 2 2 **2nd Exam** **Time: 1:30 hr** **Fall 2017** **16/12/2017**

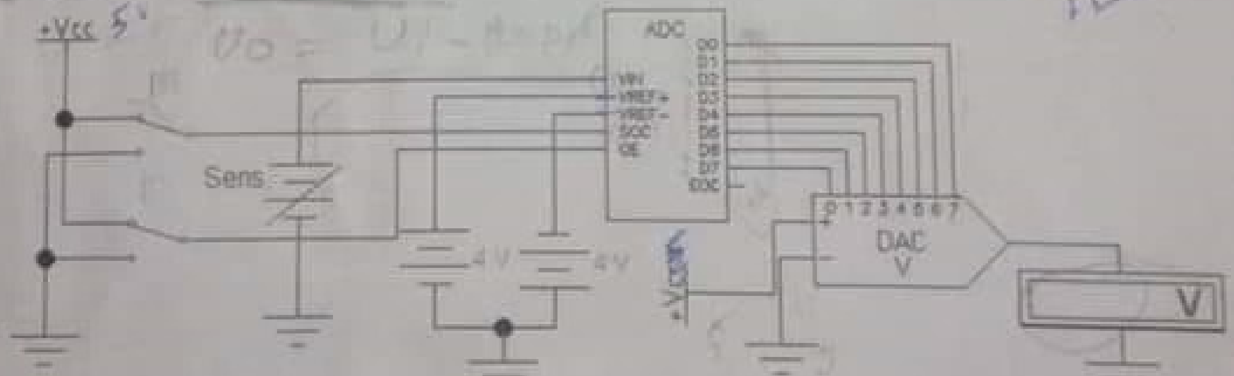
Q1) Temperature sensor sensitivity is 0.42mA/ C̊ , used for temperature range (± 50 C̊).
Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±3V.
a) What is the digital output of ADC at the temperature 31 C̊, -20 C̊.
b) What is the temperature when the digital output is B6H. [10 pts]

Q2) Design the signal conditioning circuits to connect the sensor to 8 bit ADC with voltage reference (0~10V), where: sensor output range (-100 ~ +100 mV) with frequency 25Hz, Noise signal 20mV with frequency 260Hz, and using filter that Attenuate the noise signal to 29% of its value, and taking in account the effect of the filter on the sensor signal. [10 pts]

Q3) Using pressure sensor which sensitivity is 2.3mV/bar, and temperature sensor which sensitivity is 10Ω/ C̊ and its value at zero C̊ =300Ω. Design circuit which open Valve when the pressure is more than 15bar , and operate heater when temperature is less than 20 C̊, and operate Red LED when both of them are ON. [10 pts]

20 = Ω RTD 10 Ω/

Q4) What is the digital value of the ADC output and what is the analog value of DAC output ,at the temperature 23 C̊, and -30 C̊. Where: sensor sensitivity=15mV/ C̊, sensor output at 0 C̊=100mV, sensor range=±50 C̊. [10 pts]



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256 128 64 32 16 8 4 2 1

Good Luck (Zeyad)

12864 32 16 8 4 2 1

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam Time: 2 hr Spring 2017 3/2/2018

Q1) Temperature sensor sensitivity is 4Ω/°C , in the range (±25°C) and its value at 0°C is 280Ω. Using Wheatstone bridge convert its range to volt , and send its value using (4mA –20mA transmitter) and prepare it for 8bit ADC with voltage reference 0-5Vref. .

a) What is the digital output of ADC at the temperature -2 °C. [12 pts]

Q2) Accelerometer sensor sensitivity is 0.33mA/g, used for measuring Acceleration in the range (± 20 g). Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) What is the digital output of ADC at the acceleration is -3 g. 112

b) What is the acceleration when the digital output is 06H. -19 [12 pts]

Q3) Design the signal conditioning circuits to connect the sensor to 10 bit ADC with voltage reference (0-5V), where: sensor output range (-150 – +150 mV) with frequency 15Hz. Noise signal 20mV with frequency 150Hz, and design filter that Attenuate the noise signal to 25%, and taking in account the effect of the filter on the sensor signal. [10 pts]

V_o , k, 17.62 ≈ 75

VM

Q4) Using Thermocouple sensor Type J with 0°C reference ,find the value of its output at 32°C. Design circuit to operate cooler if the temperature is more than 32°C, and using RTD with the following table using linear approximation of resistance versus temperature find the value of the RTD at 13 °C and design circuit operate heater if the temperature is less than 13°C. [12 pts]

RTD ≈ 110.85

VM ≈ 1.476 mV

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	107.6	109.1	110.2	111.1	111.7

Q5) What is the sampling and sample and hold and aliasing and oversampling (Draw as you can) [4 pts]

Good Luck (Zeyad)

b) Q.18H find P $\quad$ 18H = 24

$V_o = (24\times\Delta) - 4 = -3.25V \Rightarrow V_{in} = \frac{V_o - \text{offset}}{M} = 0.283125V$

$I = \frac{V_{in}}{R} = 1.8875\,mA$

$P = \frac{(1.8875-4)}{0.13} = 16.25$ bar ✱ .

Q4: DAC in $(01010101) = 85$, $\Delta = \frac{2}{2^8} = \frac{1}{128}$

$V_{o1} = \frac{85}{128} = \boxed{0.6640625V}$

$V_{o2} = V_{o1}\times 2.7 = \boxed{1.79296875V}$

$D_o \Rightarrow \Delta = \frac{5}{2^8} = \frac{5}{256}$, $D_o = \frac{V}{\Delta} = 91.8 = 91 + 1 = (01011011$

Q5 a)

غير داخل تقريباً

b) RTD find Quadratic Approximation then find @ 11.4

$107.6 = 110.2\left(1+\alpha_1(0-10)+\alpha_2(0-10)^2\right) \longrightarrow 1$

$111.7 = 110.2\left(1+\alpha_1(20-10)+\alpha_2(20-10)^2\right) \Rightarrow 2$

$-10\alpha_1 + 100\alpha_2 = \frac{-13}{551}$

$10\alpha_1 + 100\alpha_2 = \frac{15}{1102}$

$\alpha_1 = \frac{41}{22040}$

$\alpha_2 = \frac{-11}{220400}$

$R = 110.2\left(1+\alpha_1(11.4-10)+\alpha_2(11.4-10)^2\right) = 110.47622\Omega$

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 1:40 hr Fall 2016 1/11/2016

Q1.a) 1- Explain what is meant by active and passive sensor?

2- State the tasks of signal conditioning?

3- Using block diagram, describe a data acquisition system?

Q1.b) An instrument measures resistance from 0 to 1500Ω. What is the uncertainty in an indicated measurement of 397Ω if instrument has an accuracy of (a) ±0.5% of FS (b) ±0.5% of span?

[12 pts]

Q2.a) A current balance bridge has $R_1=R_2=10K\Omega$, $R_3=1K\Omega$, $R_4=950\Omega$, $R_5=50\Omega$, $V_s=10V$, and a high-impedance null detector. Find the current required to null the bridge if R_3 changes by 1Ω?

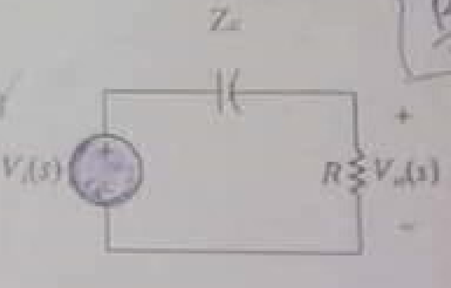
Q2.b) An air conditioning should come on when the sum of the temperature and humidity sensor voltages does above 1V. A threshold circuit in the air conditioner requires 5V for turn-on. Design an interface circuit to connect the two sensors to the air conditioning unit?

[10 pts]

Q3.a) For the following circuit:

1- Explain the behavior of the circuit when the frequency of the source changes from zero to infinity?

2- Derive the expressions of the transfer function and the cutoff frequency?



R/C

Q3.b) A displacement sensor has an input range of 0 to 3cm and a standard supply voltage Vs=0.5V. Using the calibration results in the table, estimate the sensitivity coefficients associated with supply voltage variations?

Input x (cm)	0	0.5	1	1.5	2	2.5	3
Output V (mV, Vs=0.5)	0	16.5	32	44	51.5	55.5	58
Output V (mV, Vs=0.6)	0	21	41.5	56	65	70.5	74

[10 pts]

Good Luck

$$\frac{\omega}{\sqrt{(\omega RC)^2+\omega^2}}$$

12864 32 16 8 4 2 1

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 **Final Exam** **Time: 2 hr** **Spring 2017** **3/2/2018**

Q1) Temperature sensor sensitivity is 4Ω/°C , in the range (±25°C) and its value at 0°C is 280Ω. Using Wheatstone bridge convert its range to volt , and send its value using (4mA –20mA transmitter) ,and prepare it for 8bit ADC with voltage reference 0-5Vref .

a) What is the digital output of ADC at the temperature -2 °C. [12 pts]

Q2) Accelerometer sensor sensitivity is 0.33mA/g, used for measuring Acceleration in the range (± 20 g). Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) What is the digital output of ADC at the acceleration is -3 g. 112

b) What is the acceleration when the digital output is 06H. -19 [12 pts]

Q3) Design the signal conditioning circuits to connect the sensor to 10 bit ADC with voltage reference (0-5V), where: sensor output range (-150 – +150 mV) with frequency 15Hz. Noise signal 20mV with frequency 150Hz, and design filter that Attenuate the noise signal to 25%, and taking in account the effect of the filter on the sensor signal. [10 pts] V_2 , k, 17.62 ≈ 15

JM

Q4) Using Thermocouple sensor Type J with 0°C reference ,find the value of its output at 32°C. Design circuit to operate cooler if the temperature is more than 32°C, and using RTD with the following table using linear approximation of resistance versus temperature find the value of the RTD at 13°C and design circuit operate heater if the temperature is less than 13°C. [12 pts] 6

RTD = 110.25

JM = 1.976 mV

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	107.6	109.1	110.2	111.1	111.7

Q5) What is the sampling and sample and hold and aliasing and oversampling (Draw as you can) [4 pts]

Good Luck (Zeyad)

Fall 2018

Q1 RTD Pt100 range $(22 \sim 190)$°C for SC $(0 \sim 3)$V
$V_s = 9V$, $R_1 = 200\Omega$. Sensitivity $= 0.39\,\Omega/°C$ @ 0°C = 10

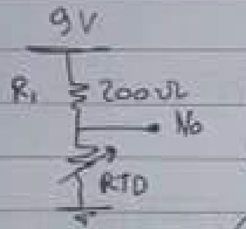
a) 22°C ~ 190°C

ohm range $(100 + 22 \times 0.39 = \underline{108.58\Omega} \sim 100 + 190 \times 0.39 = \underline{174.1\Omega})$

$R_1 = 200\Omega$ $R_4 = 108.58\Omega$ assume $R_2 = 108.58\Omega$
or 174.1

$R_3 = \frac{R_1 R_4}{R_2} = 200\Omega$ if Bridge

في السؤال طالب الحل بفرق الجهد



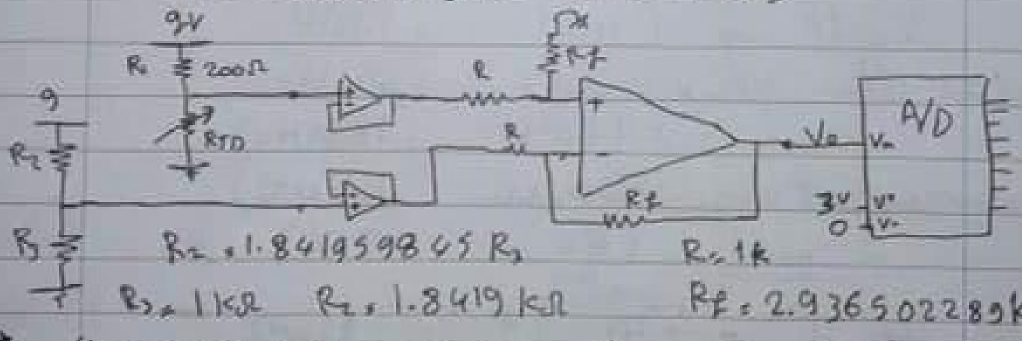
@min $= 9 \times \frac{108.58}{200 + 108.58} = 3.16V$

@max $= 9 \times \frac{174.1}{200 + 174.1} = 4.1884V$

Voltage range $(3.16V \sim 4.1884V)$

$0 = 3.16M + \text{offset} \Rightarrow M = 2.936502289$
$3 = 4.1884M + \text{offset}$ offset $= -9.299399725$

$V_o = 2.936502289\,V_{in} - 9.299399725$
$V_o = 2.936502289\,(V_{in} - 3.1668287)$



$R_2 = 1.841959845\,R_3$ $R = 1k$

$R_3 = 1k\Omega$ $R_2 = 1.8419\,k\Omega$ $R_f = 2.936502289\,k\Omega$

b) $(100 \times 0.39) + 100 = 139\Omega$. $V_o = 9\,\frac{139}{200 + 139} = 3.69026548$
$V_o = 1.537073326V \rightarrow D_o = \frac{V_o}{\Delta}$
$\Delta = \frac{3}{2^8} =$
$D_o = 131.16 = 131 = 10000011$

White/Blanc
Narrow Ruled/Réglé étroit
50 Sheets/50 feuilles

a) $T = -2°C \Rightarrow (-2\times4) + 280 = 272\,\Omega$

$V_b = 9\,\frac{272}{272+180} = \frac{612}{113}\,V$ $\quad V_{AB} = \frac{612}{113} - 4.5 = \frac{207}{226}\,V$

$V_{o1} = V_{AB} + 1 = \frac{432}{226}\,V$

$V_{o2} = (V_{o1} - 1)\frac{18}{5} = (V_{in} - 1)\frac{18}{5} = \frac{373}{113}$ $\quad \Delta = \frac{5}{2^8} = \frac{5}{256}$

$D = \frac{V_{o2}}{\Delta} = 145.8974451 = 145 = (10010001)$ ✱

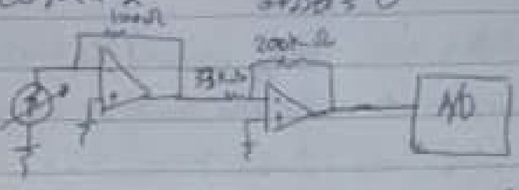
Q2) 0.33 mA/g ±20g bipolar 8bit ±4V

$-20\times0.33 = -6.6\,mA \sim 20\times0.33 = 6.6\,mA$

assume $R = 100\,\Omega \Rightarrow -0.66V \sim 0.66V$

$-4 = -0.66M + x \Rightarrow M = \frac{200}{33}$ $\quad V_o = \frac{200}{33} V_{in}$

$4 = 0.66M + x$ $\quad$ offset = 0



$\Delta = \frac{8}{2^8} = \frac{1}{32}$

a) $-3g \Rightarrow -0.99\,mA = -0.099V \Rightarrow -0.6V$

$D = \frac{-0.6+4}{\Delta} = 108.8 \simeq 108 = (01101100)_2$ ✱

b) $V_o = (6\times\Delta) - 4 = -3.8125 \xrightarrow{\div\frac{200}{33}} -\frac{2013}{3200} \xrightarrow{\div100} -6.290625\,mA$

$-19.0625\,g$ ✱

Q3) range (−150mV ~ 150mV) 10bit ADC (0~5) 1.15Hz

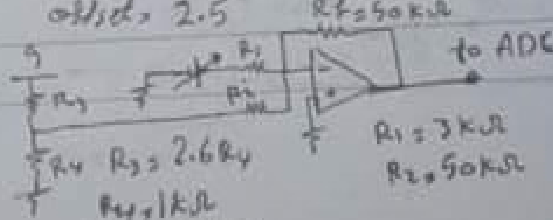
Noise 20mV @ 150Hz, a) Design S.C for ADC

b) Design filter attenuate 25% noise.

$0 = -150m\,M + x \Rightarrow M = \frac{50}{3}$ $\quad V_o = \frac{50}{3} V_{in} + 2.5$ ✱

$5 = 150m\,M + x$ $\quad$ offset = 2.5

$R_f = 50\,k\Omega$



$R_3 = 2.6R_4$

$R_4 = 1\,k\Omega$

$R_3 = 2.6\,k\Omega$

$R_1 = 3\,k\Omega$

$R_2 = 50\,k\Omega$

Sample/Sec
Hz

University of Tripoli - Faculty of Engineering

Sampl Electrical & Electronic Engineering Department

EE463 Final Exam Time: 2 hr Spring 2018 17/7/2018

X/KHz
V
1/KHz

Hz
Sample/Sec

Q1) a-What is the meaning of single ended signal and differential signal . Hz

b- Why sometimes we are holding the sampling signal . [4 pts]

Q2) Using Temperature sensor (sensitivity =5mV/C),in the range (30C to 120C) and using voltage to frequency converter VFC (scale factor= 2V/1KHz) .
Calculate the sensor output range, and VFC output range.
Using a counter to convert to digital with sampling rate 10sample/Sec, what is the value of the output of the counter if the temperature is 112C . 75 Hz [8 pts]

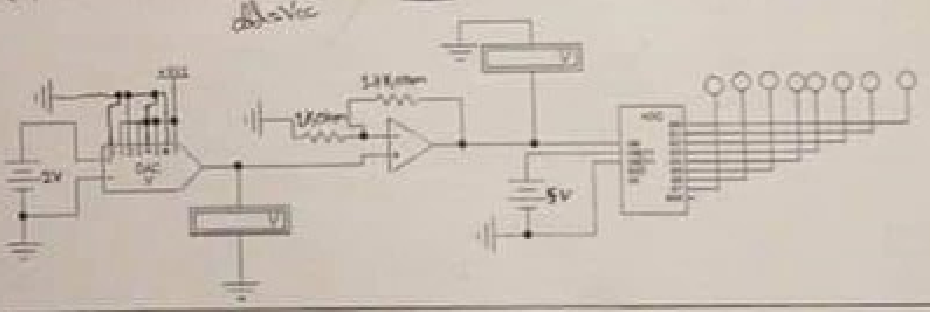
2V/1KHz
2V/1KHz
V

Q3) Barometer sensor sensitivity is 0.13mA/ bar , used for measuring pressure in the range (± 20 bar). and the value of its output @ 0 bar is 4mA, using 150 Ω ,Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) What is the digital output of ADC at the pressure is 8 bar.
b) What is the value of pressure when the digital output is 18H. [16 pts]

V/V/KHz

Q4) What is the value of voltmeters and ADC output. [12 pts]



Q5) a- Using Thermocouple sensor Type J with 40C reference ,What is the value of its output at the temperature 120C.

b- Using RTD with the following table using Quadratic approximation of resistance versus temperature find the value of the RTD at 11.4°C.

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	107.4	109.1	110.2	111.1	111.7

[10 pts]

Good Luck (Zeyad)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

Time: 1: 30 hr Fall 2017 4/11/2017

EE463 1st Exam

Q1) What is the basic elements of a data acquisition system, explain two of them?

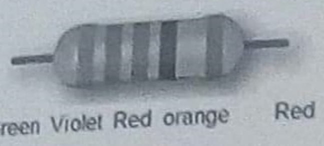
Q2) What is the deference between single ended signal and differential signal ?

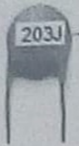
Q3) A length meter range is (0 ~ 5.5m) has quoted inaccuracy of ±2 % F.S. , what is the maximum measurement error expected for this instrument in centimeter .

Q4) What is Zero drift and sensitivity drift ?

Q5)Calculate the value of the following components:

100k = Green = 5
10000000 = Violet = 7
100 - Red = 2
1000 = orange = 3





→ 5%

Q6)RTD with sensitivity $3\Omega/\overset{o}{C}$, and its value= 320Ω @ $0\overset{o}{C}$, use wheatstone bridge to calculate its range in volt for temperature range (0 ~ 70 $\overset{o}{C}$) . design s.c. circuit for ADC which voltage reference (0 ~ 4V) .

-Get the temperature equation

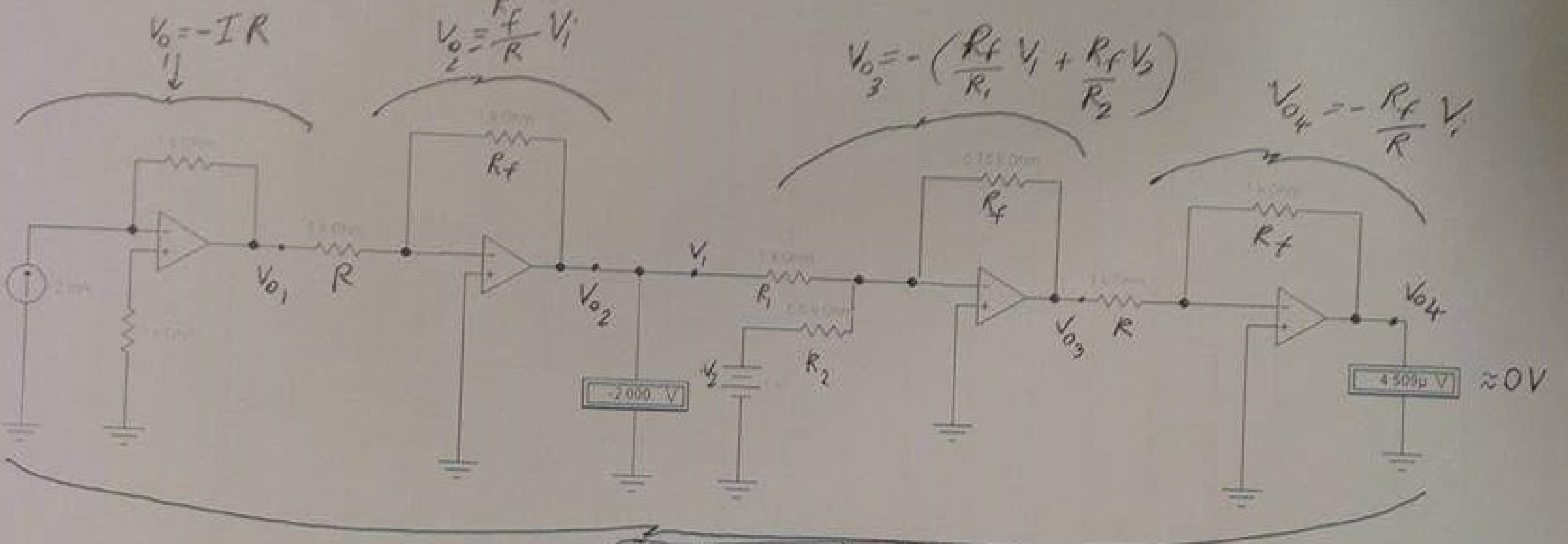
Q7) sensitivity of pressure sensor is (2.8 mA/bar) working in the range (0~15bar) , in a noisy area, design a circuit to transmit its data using (4m ~20mA) transmitter , What is the new range in volt of the sensor .

Good Luck

Better 9
Be 8
Right 7
or 6
your 5
Best 4
guess 3
goes 2
Very 1
Wrong 0

$A.B \times 10^{c}$

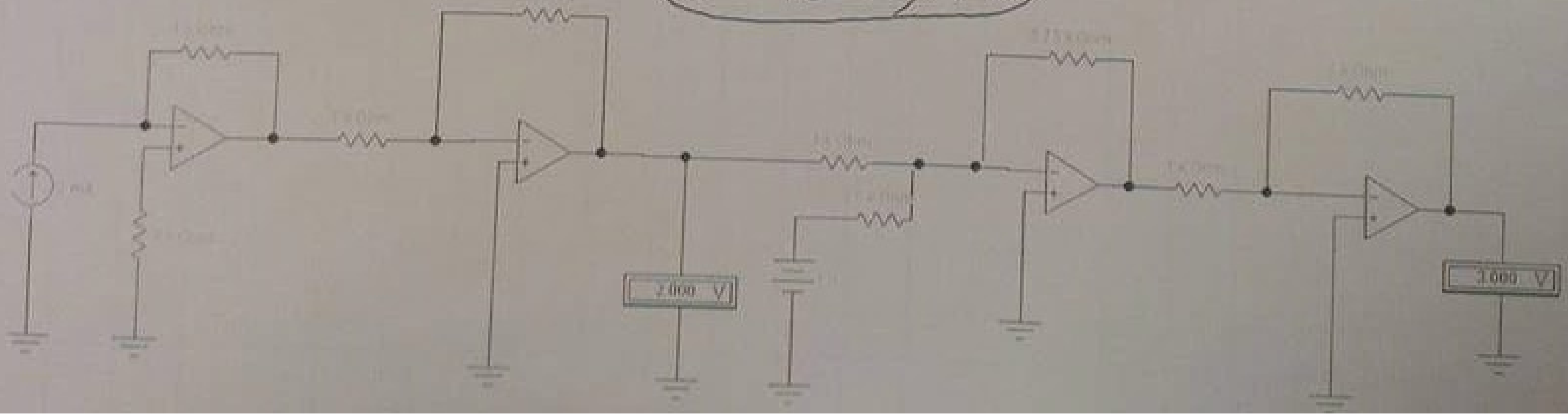
when
-2mA



$V_{o_1} = -IR$
$V_{o_2} = \frac{R_f}{R} V_i$
$V_{o_3} = -\left(\frac{R_f}{R_1} V_1 + \frac{R_f}{R_2} V_2\right)$
$V_{o_4} = -\frac{R_f}{R} V_i$
V_{o_1}
R
R_f
V_{o_2}
V_1
R_1
R_2
V_2
V_{o_3}
V_{o4}
-2.000 V
4.509μ V
≈0V

$$\boxed{V_o = V_i(0.75)+1.5}$$

when
2mA



2.000 V
3.000 V

Q1) Accelerometer sensitivity 0.2 mA/g calculate it's output range in (± 10 g), Design signal conditioning circuit for ($0 \sim 3V$) ADC

range ($-2 \sim 2mA$)

($0.2 \times -10 \sim 0.2 \times 10$ mA)

($-2 \sim 2V$) في حالة إختيار

المقاومة (1k)

$0 = -2M + \text{offset}$

$3 = 2M + \text{offset}$

$3 = 4M$

$m = \frac{3}{4}$ $\quad V_o = V_i M + \text{offset}$

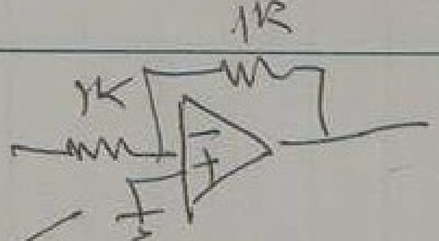
$= V_i(0.75) + 1.5$

V_i	-2V	0	2V
V_o	0	1.5	3

لعكس الإشارة

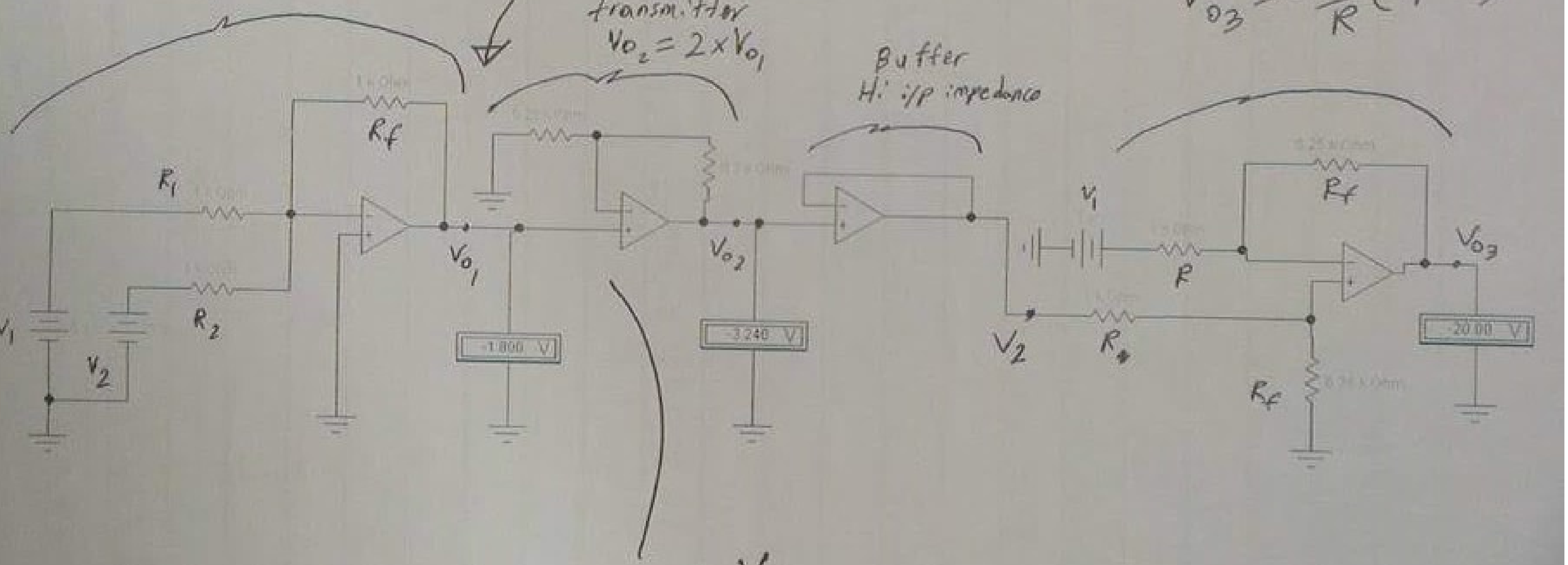
HW#1 EE463 22142698

ANS)Q2)



$$V_{o_1} = -\left(\frac{R_f}{R_1}V_1 + \frac{R_f}{R_2}V_2\right)$$

$$V_{o_3} = -\frac{R_f}{R}(V_1 - V_2)$$


transmitter
$V_{o_2} = 2 \times V_{o_1}$
Buffer
Hi i/p impedance
R_f
R_1
R_2
V_1
V_2
V_{o_1}
-1.800 V
V_{o_2}
-3.240 V
V_1
R_f
R
V_{o_3}
-20.00 V
V_2
R_*
R_f

لا يعمل أبداً!!
إلا في حالة المدى (١-٥V)

Q2 Sensitivity 0.1V/g rang (0~8g) m/s^2
we want to signal
Condition data for 2ometer to
use it for (0~5) ADC

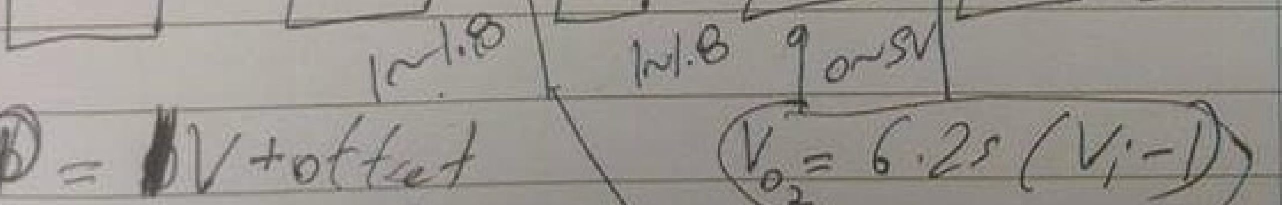
$0 = 1M + \text{offset}$
$5 = 1.8M + \text{offset}$

$5 = 0.8M \Rightarrow M = \frac{5}{0.8} = 6.25$

$\text{offset} = -6.25$

$V_o = V_i \cdot 6.25 - 6.25 = 6.25(V_i - 1)$

V_i	1	1.4	1.8
V_o	0	2.5	5


0~0.8
sensor
S.C.
V_{o1}
S.C.
A/D
1~1.8
1~1.8
0~5V

$0 = V + \text{offset}$
$5 = 1.8V + \text{offset}$

$V_{o2} = 6.25(V_i - 1)$

$V_{o1} = V_i + 1$

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam Time: 2 hr Spring 2017 3/2/2018

Q1) Temperature sensor sensitivity is 4Ω/°C , in the range (±25°C) and its value at 0°C is 280Ω. Using Wheatstone bridge convert its range to volt , and send its value using (4mA -20mA transmitter) ,and prepare it for 8bit ADC with voltage reference 0-5Vref.

a) What is the digital output of ADC at the temperature -2 °C. [12 pts]

Q2) Accelerometer sensor sensitivity is 0.33mA/g , used for measuring Acceleration in the range (± 20 g). Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) What is the digital output of ADC at the acceleration is -3 g.

b) What is the acceleration when the digital output is 06H. [12 pts]

Q3) Design the signal conditioning circuits to connect the sensor to 10 bit ADC with voltage reference (0 - 5V), where sensor output range (-150 - +150 mV) with frequency 15Hz. Noise signal 20mV with frequency 150Hz, and design filter that Attenuate the noise signal to 25%, and taking in account the effect of the filter on the sensor signal. [10 pts]

Q4) Using Thermocouple sensor Type J with 0°C reference ,find the value of its output at 32°C. Design circuit to operate cooler if the temperature is more than 32°C, and using RTD with the following table using linear approximation of resistance versus temperature find the value of the RTD at 13°C and design circuit operate heater if the temperature is less than 13°C. [12 pts]

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	107.8	109.1	110.2	111.1	111.7

Q5) What is the sampling and sample and hold and aliasing and oversampling (Draw as you can) [4 pts]

Good Luck (Zeyad)

[illegible]

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 2nd Exam Time: 1:30 hr Fall 2017 16/12/2017

Q1) Temperature sensor sensitivity is 0.42mA/ °C , used for temperature range (± 50 °C). Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±3V.

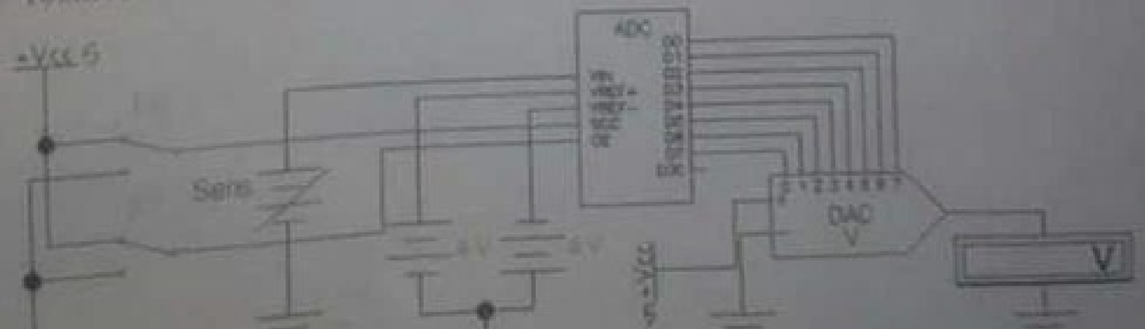
a) What is the digital output of ADC at the temperature 31 °C, -20 °C.

b) What is the temperature when the digital output is B6H. [10 pts]

Q2) Design the signal conditioning circuits to connect the sensor to 8 bit ADC with voltage reference (0–10V), where: sensor output range (-100 ~ +100 mV) with frequency 25Hz, Noise signal 20mV with frequency 260Hz, and using filter that Attenuate the noise signal to 29% of its value, and taking in account the effect of the filter on the sensor signal. [10 pts]

Q3) Using pressure sensor which sensitivity is 2.3mV/bar, and temperature sensor which sensitivity is 10Ω/ °C and its value at zero °C =300Ω. Design circuit which open Valve when the pressure is more than 15bar , and operate heater when temperature is less than 20 °C, and operate Red LED when both of them are ON. [10 pts]

Q4) What is the digital value of the ADC output and what is the analog value of DAC output at the temperature 23 °C, and -30 °C. Where: sensor sensitivity=15mV/ °C, sensor output at 0 °C=100mV, sensor range=± 50 °C. [10 pts]



Good Luck (Zeyad)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam Time: 2 hr Fall 2018 12/2/2019

Q1) a-Using RTD PT100 for temperature range (22C to 190C),design a signal conditioning circuit for (0–3V) ADC.(use voltage divider circuit , Vs=9V,R1=200Ω).

b-If we will send the sensor output for a distance with same voltage reference.

c-What is the ADC digital output if the temperature is 100C.

d-What is the temperature if the ADC output is (10011110). ref = 2V [14 pts]

Q2) Using Acceleration sensor (sensitivity =0.14mA/g),with offset 7mA@0g, for the range (±30g) and using voltage to frequency converter VFC (scale factor= 4V/6KHz) .

a-Draw the block diagram of the operation.

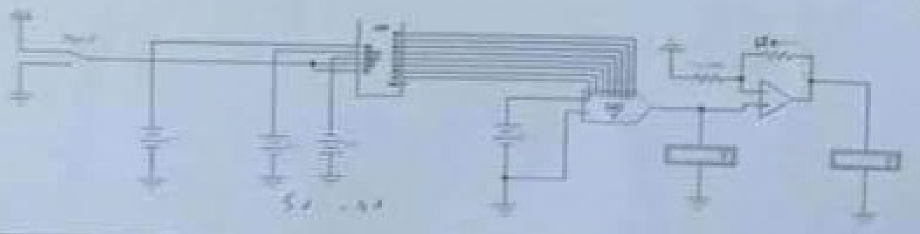
b-Calculate the sensor output range, and VFC output range, digital output of counter if the sampling is each 0.2Sec.

c-What is the value of the output of the counter if the acceleration is -0.5g. [10 pts]

Q3) Barometer sensor sensitivity is 5mV/ bar , and 5Ω/cm pot. level sensor for 150cm range used for measuring level (Vs=9Vuse, R1= 150 Ω) ,Design) circuit to turn ON green LED if (level more than 70cm and pressure less than 5bar),red LED if one of them opposite these values.

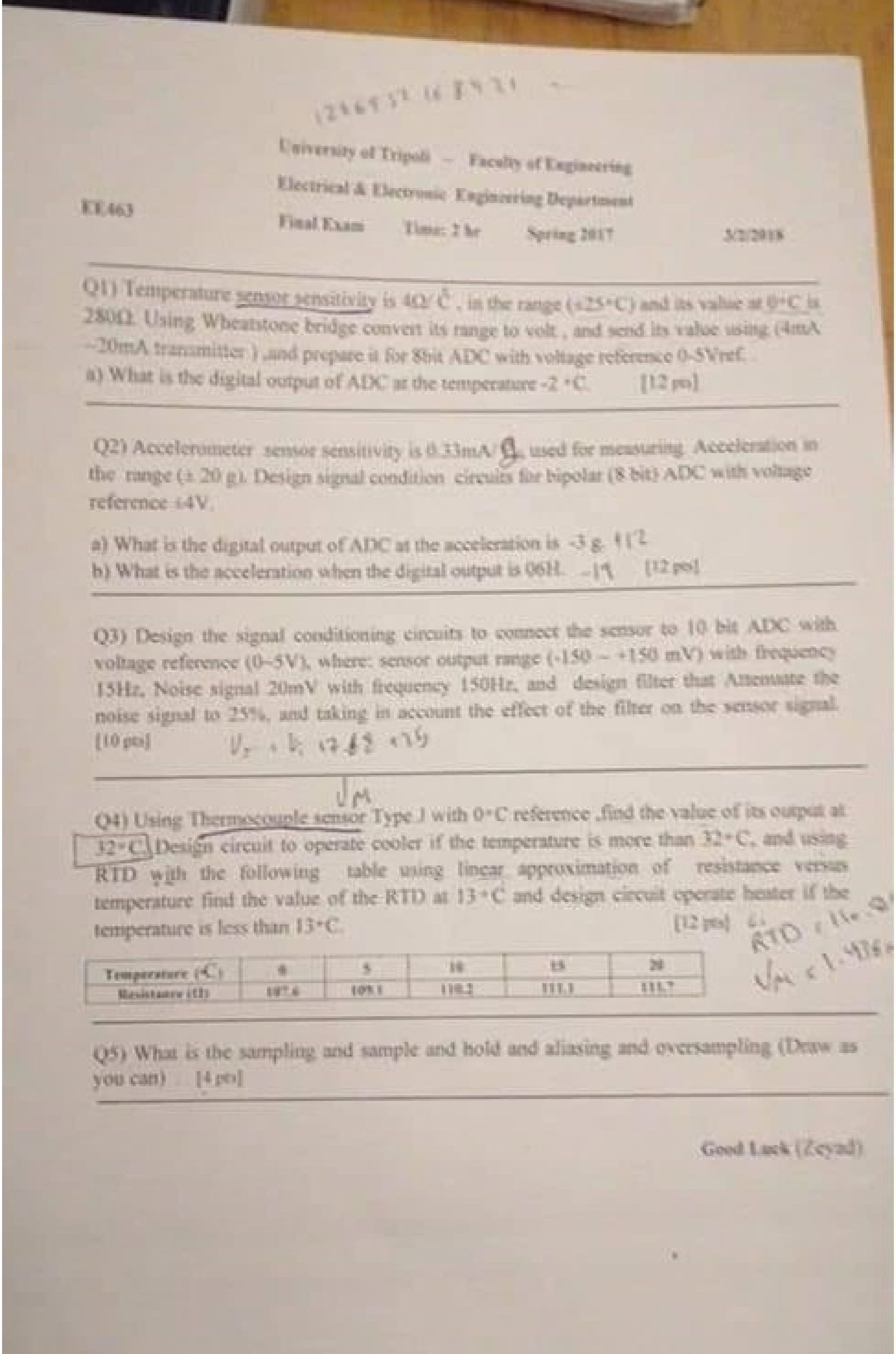
[10 pts]

Q4) What is the value of voltmeters and ADC and DAC outputs. [8 pts]



Q5) a- Using Thermocouple sensor Type K with 0C reference, What is the value of temperature if its output is 19mV, What is its output at the temperature Vro(-40C)=?. (8pts)

Good Luck (Zeyad)



[illegible]

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463

Final Exam Time: 2 hr Spring 2017 3/2/2018

Q1) Temperature sensor sensitivity is 4Ω/°C, in the range (±25°C) and its value at 0°C is 280Ω. Using Wheatstone bridge convert its range to volt, and send its value using (4mA ~20mA transmitter) ,and prepare it for 8bit ADC with voltage reference 0-5Vref.

a) What is the digital output of ADC at the temperature -2 °C. [12 pts]

Q2) Accelerometer sensor sensitivity is 0.33mA/g, used for measuring Acceleration in the range (± 20 g). Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) What is the digital output of ADC at the acceleration is -3 g. 112

b) What is the acceleration when the digital output is 06H. -19 [12 pts]

Q3) Design the signal conditioning circuits to connect the sensor to 10 bit ADC with voltage reference (0~5V), where: sensor output range (-150 ~ +150 mV) with frequency 15Hz, Noise signal 20mV with frequency 150Hz, and design filter that Attenuate the noise signal to 25%, and taking in account the effect of the filter on the sensor signal. [10 pts] [illegible]

Jm

Q4) Using Thermocouple sensor Type J with 0°C reference ,find the value of its output at $\boxed{32°C}$ Design circuit to operate cooler if the temperature is more than 32°C, and using RTD with the following table using linear approximation of resistance versus temperature find the value of the RTD at 13°C and design circuit operate heater if the temperature is less than 13°C. [12 pts]

RTD = 11[illegible]

Jm = 1.936[illegible]

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	107.6	109.1	110.2	111.1	111.7

Q5) What is the sampling and sample and hold and aliasing and oversampling (Draw as you can) [4 pts]

Good Luck (Zeyad)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam- Time: 2 hr Spring 2019 25/9/2019

Q1) a-What is the meaning of single ended signal, differential signaland give example.

b- What is sample and what is hold and when we use them. [6 pts]

Q2) Using Temperature sensor (RTD-PT100),in the range (30C to 90C) and using Wheatstone bridge (Vs=9V, R1=110, R2=120),and using voltage to frequency converter VFC (scale factor= 10KHz/1.12V) .

a- Calculate the sensor output range, Wheatstone bridge output range and VFC output range.

b- Using a counter to convert to digital with sampling rate 180 sample/Sec,What is the output range of the counter, what is the value of the output of the counter if the temperature is ~~[illegible]~~C . 55C°

c- Draw Block diagram of the circuit. [16 pts]

Q3) An accelerometer sensor sensitivity is 0.145mA/ g , used for measuring pressure in the range (± 20 g): and the value of its output @ 0 g is 5.2mA, using 190 Ω converting to volt resistance ,Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±4V.

a) Calculate sensor output range (current,voltage,Binary).

b) What is the digital output of ADC at the acceleration is 8 g.

c) What is the value of acceleration when the digital output is 0DH,92H. [15 pts]

d) If the frequency of the signal is 120Hz and there is unwanted noise with frequency 15KHz, design filter that attenuate the noise to 18% of its value, calculate the effect on the sensor output range.

[05 pts]

Q4) Using RTD with the following table using Quadratic approximation of resistance versus temperature find the value of the RTD at 12.4°C.

Temperature (°C)	0	5	10	15	20
Resistance (Ω)	103.6	105.1	106.3	107.1	108.3

[08 pts]

Good Luck (Zeyad)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 75min Spring 2017 18/4/2017

Q1.a) An alarm light goes ON when a pressure sensor voltage rises above 4.00 V. The pressure sensor outputs 20 mV/kPa and has a time constant of 4.9 s. How long after the pressure rises suddenly from 100 kPa to 400 kPa does the light go ON?

Q1.b) A load cell is calibrated at 21^{c° and has the following deflection/load characteristic:

Load(kg)	0	50	100	150	200
Deflection (mm)	0	1	2	3	4

When used at 35^{c°, its characteristic changes to the following:

Load(kg)	0	50	100	150	200
Deflection (mm)	0.2	1.3	2.4	3.5	4.6

Determine the sensitivity coefficients [10 pts]

Q2.a) A measurement signal has a frequency less than 1KHz, but there is unwanted noise at about 1MHz. Design a filter that attenuate the noise to 1% using a capacitor 0.01µf. What is the effect on the measurement signal at its maximum of 1KHz (give a comment on the result)?

Q2.b) Signal conditioning analysis shows that the following equation must relate output voltage to input voltage: $V_o=3.35V_{in} - 2.68$. Design circuits to do this using a differential amplifier? [12 pts]

Q3.a) Using timing diagram, explain the control lines that coordinate the operation of ADCs?

Q3.b) Design a 5-bit weighted-resistor DAC whose full-scale output voltage is -15v. Logic levels are 1=5v and 0=0v. What is the output voltage when the input is 01010?

[10 pts]

Good Luck

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 Final Exam Time: 2 hr Fall 2018 12/2/2019

Q1) a-Using RTD PT100 for temperature range (22C to 190C) design a signal conditioning circuit for (0–3V) ADC (use voltage divider circuit, Vs=9V, R1=200Ω).

~~b-~~If we will send the sensor output for a distance with same voltage reference.

ⓒ-What is the ADC digital output if the temperature is 100C.

d-What is the temperature if the ADC output is (10011110). [14 pts]

Q2) Using Acceleration sensor (sensitivity =0.14mA/g), with offset 7mA@0g, for the range (±30g) and using voltage to frequency converter VFC (scale factor= 4V/6KHz).

a-Draw the block diagram of the operation.

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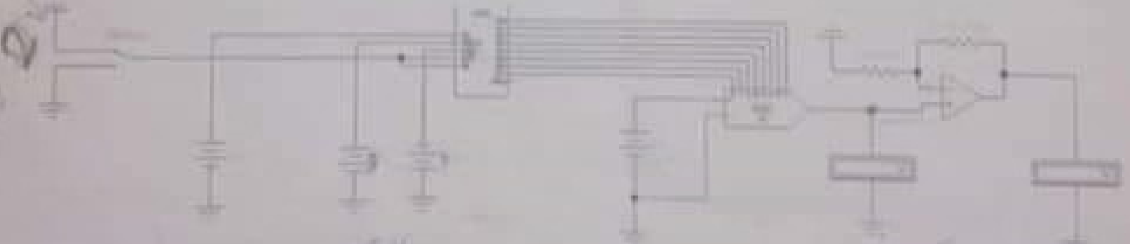
Q4) What is the value of voltmeters and ADC and DAC outputs. [8 pts]



Q5) a- Using Thermocouple sensor Type K with 0C reference, What is the value of temperature if its output is 19mV, What is its output at the temperature $V_{K10}(-40C)$=?. [8pts]

Good Luck (Zeyad)

3
1.5 1.5
2 2

University of Tripoli – Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 2nd Exam Time: 1:30 hr Fall 2017 16/12/2017

3R

Q1) Temperature sensor sensitivity is 0.42mA/ C̊ , used for temperature range (± 50 C̊). Design signal condition circuits for bipolar (8 bit) ADC with voltage reference ±3V.

a) What is the digital output of ADC at the temperature 31 C̊, -20 C̊.

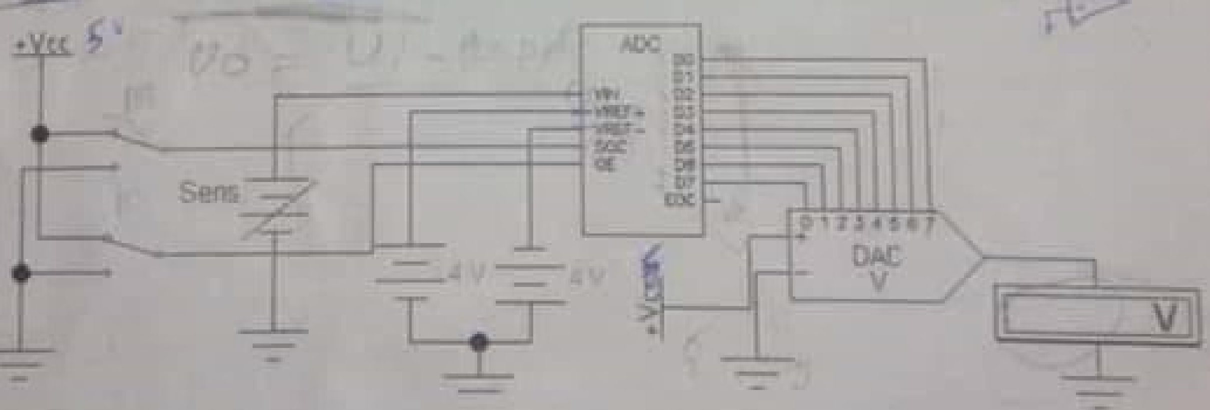
b) What is the temperature when the digital output is B6H. [10 pts]

Q2) Design the signal conditioning circuits to connect the sensor to 8 bit ADC with voltage reference (0~10V), where: sensor output range (-100 ~ +100 mV) with frequency 25Hz, Noise signal 20mV with frequency 260Hz, and using filter that Attenuate the noise signal to 29% of its value, and taking in account the effect of the filter on the sensor signal. [10 pts]

Q3) Using pressure sensor which sensitivity is 2.3mV/bar, and temperature sensor which sensitivity is 10Ω/ C̊ and its value at zero C̊ =300Ω. Design circuit which open Valve when the pressure is more than 15bar , and operate heater when temperature is less than 20 C̊, and operate Red LED when both of them are ON. [10 pts]

20 = Ω RTD 10 Ω/

Q4) What is the digital value of the ADC output and what is the analog value of DAC output at the temperature 23 C̊, and -30 C̊. Where: sensor sensitivity=15mV/ C̊, sensor output at 0 C̊=100mV, sensor range=±50 C̊. [10 pts]



256 128 64 32 16 8 4 2 1

Good Luck (Zeyad)

University of Tripoli - Faculty of Engineering

Electrical & Electronic Engineering Department

EE463 1st Exam Time: 1: 30 hr Fall 2017 4/11/2017

Q1) What is the basic elements of a data acquisition system, explain two of them?

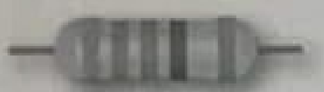
Q2) What is the deference between single ended signal and differential signal ?

Q3) A length meter range is (0 ~ 5.5m) has quoted inaccuracy of ±2 % F.S. , what is the maximum measurement error expected for this instrument in centimeter .

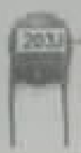
Q4) What is Zero drift and sensitivity drift ?

Q5)Calculate the value of the following components:

100K = Green = 5
10000000 = Violet = 7
100 - Red = 2
1000 = orange = 3



Green Violet Red orange Red



→ 5%

Q6)RTD with sensitivity 3Ω/$\overset{\circ}{C}$, and its value= 320Ω @ 0$\overset{\circ}{C}$, use wheatstone bridge to calculate its range in volt for temperature range (0 ~ 70 $\overset{\circ}{C}$) . design s.c. circuit for ADC which voltage reference (0 ~ 4V).

-Get the temperature equation

Q7) sensitivity of pressure sensor is (2.8 mA/bar) working in the range (0~15bar) , in a noisy area, design a circuit to transmit its data using (4m ~20mA) transmitter , What is the new range in volt of the sensor .

Good Luck

Better 9
Be 8
Right 7
or 6
your 5
Best 4
guess 3
goes 2
Very 1
Wrong 0

$A . B \times 10^{C}$